

## Cemented Versus Uncemented Hemiarthroplasty in the Management of Fracture Neck of Femur. A Comparative Study

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### Abstract

**Background:** The study has been carried out to study the advantages, complications, morbidity and mortality rates, the recovery to physical independence encountered in each of the procedure and to draw a conclusion based on study results as to which of the above type of implant and type of fixation would be better in the management of fracture neck of the femur for elderly. **Methods:** The prospective comparative study includes 60 cases of displaced intracapsular fracture neck of femur in elderly aged more than 60 years, divided into 2 groups with 30 patients assigned randomly. One group was treated with press-fit uncemented hemiarthroplasty whereas the other group was treated with cemented hemiarthroplasty. Postoperatively cases were followed up for 12 months period and functional evaluation was done at the end of this period using Harris hip score and VAS score. **Results:** There was no statistical difference in Harris hip score and VAS score between the two groups. A significant statistical difference exists in terms of surgical time (97.63 minutes versus 60.83 minutes) and blood loss (298.67 ml versus 181.83 ml) for the cemented cohort than the uncemented. **Conclusion:** Both cemented and uncemented bipolar hemiarthroplasty provides same functional results at 1-year follow-up for treatment of non-displaced fracture neck of femur. However, cemented hemiarthroplasty has less postoperative pain and complications.

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### INTRODUCTION

The fracture neck of the femur is associated with one of the most serious health problems affecting the geriatric population. It is associated with a high risk of morbidity, low quality of life, and premature mortality. It has always presented great challenges for orthopedic surgeons.

The incidence of hip fractures is 159/100,000 population in India and out of these 50% are fracture neck of the femur.<sup>[1]</sup> The incidence of these fractures is expected to be double in

the next twenty years and triple by 2050. The prevalence of fracture also doubles for each decade after the fifth decade. With an increase in the geriatric population, the burden of this fracture and its sequelae continue to be on the rise. Incidence of femur neck fracture in young is low and it is due to high-velocity trauma whereas its incidence is high in the elderly and is mainly a result of low energy falls. Major risk factors associated with fracture neck femur are osteoporosis (particularly in postmenopausal women), female sex, increasing age,



tobacco and alcohol consumption, metastatic disease, and metabolic bone diseases.

Non-operative treatment of fracture neck of femur includes bed rest with or without traction. This results in the increased incidence of non-union, secondary displacement, and avascular necrosis.<sup>[2]</sup> Surgical treatment is the open or close reduction and internal fixation using cannulated screws or sliding hip screw. Sometimes this is associated with non-union, AVN, Implant failure. Reconstruction options include hemiarthroplasty (HA) - unipolar or bipolar and total hip arthroplasty.<sup>[2,3]</sup> Further unipolar or bipolar stems can be fixed with proximal femur using bone cement - cemented hemiarthroplasty or stems can be press-fit with proximal femur - uncemented hemiarthroplasty.

In cemented hemiarthroplasty, polymethylmethacrylate bone cement is used during surgery to create a solid bone-implant interface. Cemented bipolar prosthesis is associated with less post-operative thigh pain, as the prosthesis is firmly fixed within the femur.<sup>[3]</sup> Bone Cement Implantation Syndrome (BCIS) is a side effect of using cement. The syndrome is potentially life threatening and is characterized by hypoxia and/or hypotension in combination with an unexpected loss of consciousness. However, advantages are early ambulation.

Uncemented hemiarthroplasties are placed press-fit in the femur. In the

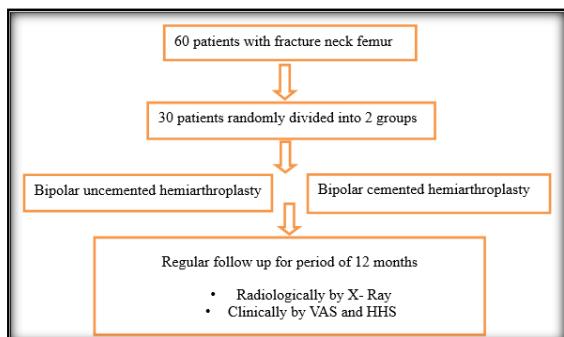
weeks after the surgery, the bond between the femur and the stem is dependent on osseous integration. However, bone quality is generally poor in the elderly, which may lead to periprosthetic fractures during press-fit placement or inadequate bony ingrowth post-operatively,<sup>[4]</sup> loosening of the implant, pain, and gait abnormality.

Total hip arthroplasty is not popular in our country for treatment of fracture neck of femur due to high cost of implants and hemiarthroplasty provide good results. Also THR is more extensive procedure resulting in increased morbidity.

## MATERIALS AND METHODS

The prospective comparative study was conducted in the department of Orthopaedic at Veer Surendra Sai Institute of Medical Sciences and Research, Burla from 2017 to 2019 included 60 cases of intracapsular fracture neck of femur in the elderly aged more than 60 years where 30 patients were treated by hemiarthroplasty using uncemented fenestrated prosthesis whereas 30 patients were treated with hemiarthroplasty using cemented non-fenestrated prosthesis. Patients of age more than 60 years with the closed displaced neck of femur fracture were included in this study. Patients with basicervical neck femur fracture, valgus impacted fracture, pathological fracture, associated with other fractures such as ipsilateral shaft femur fracture and acetabulum

fracture, active infection around the hip, and surgically unfit patients were excluded from the study. The Ethical clearance was obtained from the ethical committee, VIMSAR, and written informed consent was obtained from patients participating in the study.

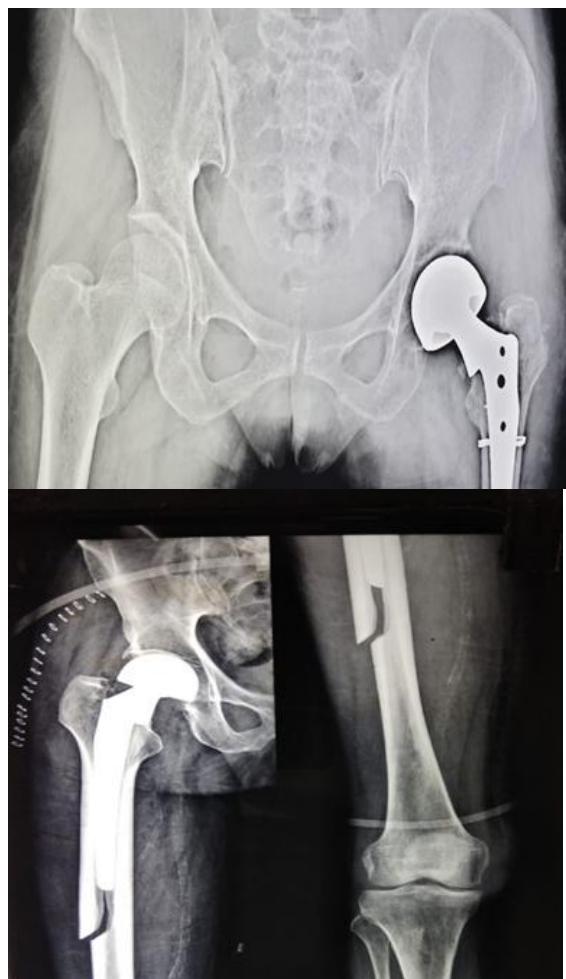


**Figure 1:** Flowchart showing the distribution of sample and study method.

Follow-up was performed at 6 weeks, 3 months, 6 months, and 1 year after the surgery. The intensity of the pain (based on visual analog scale), hip function (according to Harris hip score), radiological signs of patient's x-ray (the presence or absence of acetabular erosion, loosening of the prosthesis, heterotopic ossification), and postoperative complications were recorded. All data including age, sex, type of treatment, intraoperative bleeding volume, the mortality rate (during surgery until discharge), and treatment costs were collected by a questionnaire and checklist and analyzed by SPSS-19. Frequency, ratio, a mean, and standard deviation of variables were calculated, to compare quantitative variables for which chi-square was used. Binary variables were analyzed by Fisher's exact test,

and continuous outcomes were analyzed with the use of the Student's t-test (two-tailed).  $P<0.05$  was considered significant for all analyses.

## RESULTS



**Figure 2: A and B Periprosthetic fracture following uncemented hemiarthroplasty.**

Both occurred during reduction of prosthesis. A. was managed with intraoperative reduction and fixation with SS wire whereas B. was managed conservatively. Weightbearing was delayed in both the cases.

60 patients with fracture neck femur were operated on for hemiarthroplasty, cemented or



uncemented, during the study period. The mean age was  $68.45 \pm 5.78$  years with the cemented cohort and  $65.37 \pm 6.15$  years in the uncemented cohort. Of these, 25 (41.7%) were men and 35(58.3%) were female. The most common mechanism of injury was a trivial fall (88.33%) as opposed to a road traffic accident (11.67%). [Table 1].

The mean operation time was 97.63 minutes in the cemented group and 60.83 minutes in the uncemented group. The mean of the intraoperative bleeding volume was 298.67cc and 181.83cc in cement and uncemented groups, respectively ( $P<0.05$ ) [Table 2]. In the uncemented cohort, the average vas score is 2.93 at 6 weeks, at 6 months 1.87 and at 12 months is 1.2 whereas, in the cemented cohort, the average vas score at 6 weeks is 2.67, at 6 months is 1.43and at 12 months is 1.13. There was no statistical significance at 6 weeks and 12 months. Harris hip score (HHS) assesses the overall function of the hip following bipolar hemiarthroplasty. In the

uncemented cohort, the average HHS score is 65.99 at 6 weeks, at 6 months is 74.20 and at 12 months is 79.68 whereas, in the cemented cohort, the average HHS score at 6 weeks is 70.42, at 6 months is 78.80 and at 12 months is 84.35. No statistical significance is observed.

Total Functional outcome at 12 months by Harris Hip Score follow up was found to be statistically insignificant. In the uncemented cohort, 6 patients (20%) had excellent results; 9 patients (30%) had good results and 9 patients (30%) had fair results and 6 patients (20%) had poor results; whereas in the cemented cohort, 9 patients (30%) had excellent results; 13 patients (43.33%) had good results; 4 patients (13.33%) had fair results and 4 patients (13.33%) had poor functional result.

The intraoperative and postoperative total complication rate was 20% in cemented cohort and 23.3 % in the uncemented cohort which was not statistically significant [Table 4] ( $P<0.05$ ).

**Table 1: Demographic variables of two groups of study patients**

Variables	Uncemented (N=30)	Cemented (N=30)	P-value
Age(year) (Mean $\pm$ SD)	$65.37 \pm 6.15$	$68.45 \pm 5.78$	0.049
Male (%)	13(43.3)	12(40.0)	0.793
Female (%)	17(56.7)	18(60.0)	
Right side (%)	14 (46.7)	11 (36.7)	0.432
Left side (No)	16 (53.3)	19 (63.3)	
Garden Type 3	12 (40.0)	10 (33.3)	0.592
Garden Type 4	18 (60.0)	20 (66.7)	
Injury due to fall	26 (86.6)	27 (90.0)	0.687
Injury due to RTA	4 (13.3)	3 (10.0)	

\*Significant at  $P = 0.05$ .

**Table 2: Operative Variables between 2 groups.**

	<b>Uncemented</b>	<b>Cemented</b>	<b>P-Value</b>
Blood Loss (in ml)	$181.83 \pm 10.62$	$298.67 \pm 19.51$	0.001
Operative Time (in min)	$60.83 \pm 4.74$	$97.63 \pm 6.31$	<0.001

**Table 3: Comparison between total functional outcomes at 12 months.**

<b>Criteria</b>	<b>Uncemented</b>		<b>Cemented</b>	
	<b>Frequency</b>	<b>Percentage</b>	<b>Frequency</b>	<b>Percentage</b>
Excellent	6	20.00	9	30.00
Good	9	30.00	13	43.33
Fair	9	30.00	4	13.33
Poor	6	20.00	4	13.33
Total	30	100.00	30	100.00
P value	0.077 – statistically insignificant			

**Table 4: Distribution of complications in both the groups**

<b>Complications</b>	<b>Uncemented</b>		<b>Cemented</b>		<b>P-value</b>
	<b>Frequency</b>	<b>Percentage</b>	<b>Frequency</b>	<b>Percentage</b>	
Death	0	0.00	0	0.00	>0.05
Periprosthetic fracture	2	6.67	0	0.00	
Deep Infection	0	0.00	0	0.00	
Superficial Infection	2	6.67	1	3.33	
Dislocation	0	0.00	1	3.33	
Bedsore	3	10.00	2	6.67	
BCIS	0	0.00	1	3.33	
Sciatic Neuropapraxia	0	0.00	1	3.33	

## DISCUSSION

Neck of femur fracture are common injuries among elderly people and often due to trivial fall. The most common treatment for a displaced femoral neck fracture in the elderly is hemiarthroplasty.

The hemiarthroplasty is either cemented into the femoral canal or uncemented with the press-fit

technique. The question of whether cemented hemiarthroplasty is better for neck femur fracture has been a topic of controversy and ongoing debate.

The most common fixation method of the femoral stem has been cementing with PMMA bone cement. However, this method has some disadvantages. The duration of surgery is longer than in uncemented techniques. Blood loss is higher and there is a risk of sudden



death due to BCIS. There exists a debate about the superiority of the cemented and uncemented prosthesis. In this context, we undertook the present study to evaluate the immediate results of a comparative study of an uncemented hemiarthroplasty with cemented hemiarthroplasty in the geriatric population. The results were analyzed and observations were made. This study was comparable with similar studies.

Figved et al,<sup>[5]</sup> found after comparing a cemented hemiarthroplasty with an uncemented, hydroxyapatite-coated implant that mean Harris hip score showed equivalence between the groups throughout the followup period of 1 year. In the uncemented group, the mean duration of surgery was shorter and the mean intraoperative blood loss was found to be less. The Barthel Index and EQ-5D scores did not show any differences between the groups. The rates of complications and mortality were similar between groups. They concluded that both arthroplasties may be used with good results after displaced femoral neck fractures.

Lo et al,<sup>[13]</sup> found less thigh pain (13% versus 46.2%) and higher Harris hip scores (86 versus 79) in the cemented group in comparison with the uncemented group. In the cemented group, radiology revealed fewer radiolucent zones and prosthesis subsidence. Heterotopic ossification was more common in the cemented group. Cemented hemiarthroplasty took more time for surgery (average 20

minutes) and blood loss was more (average 160 ml). However, there was no significant difference in the early mortality rate observed between these two groups.

A meta-analysis study by Li et al,<sup>[14]</sup> found that the operative time of cemented hemiarthroplasty was more than that of uncemented and was statistically significant. Blood loss during surgery was higher in cemented hemiarthroplasty but was statistically insignificant. Better functional outcome in terms of HHS was found to be higher for cemented hemiarthroplasty and was statistically significant. The pulmonary complication was also higher in cemented arthroplasty was significant but another complication was comparable in both the groups. However, there was no significant difference in terms of mortality at 12 months.

A meta-analysis study by Ning et al,<sup>[15]</sup> compared cemented with uncemented hemiarthroplasty. Operative time of cemented hemiarthroplasty was more but was statistically insignificant. They did not find any statistical difference between the two groups in terms of blood loss, residual thigh pain, complication, and mortality rates.

In our study, improvement in terms of functional outcome (HHS) and pain score (VAS) was observed from 6 weeks to 12 months in both cemented and uncemented hemiarthroplasty but was not found to be statistically significant. However better HHS and VAS are observed in cemented



hemiarthroplasty. Other studies have found statistically significant differences in favor of cemented hemiarthroplasty.<sup>[4,5,9-15]</sup>

Cemented Hemiarthroplasty takes more operative time and more blood loss when compared to uncemented. This was found to be statistically significant. Other studies showed similar results were done by Figved et al,<sup>[5]</sup> Xing Man et al,<sup>[6]</sup> and Lo et al.<sup>[13]</sup>

Two cases of periprosthetic fracture were found during uncemented hemiarthroplasty which occurred during the reduction of the prosthesis. Figved et al,<sup>[5]</sup> Khan et al,<sup>[7]</sup> and Foster et al,<sup>[8]</sup> found similar results. 1 case of dislocation was found in the cemented group which was managed by closed reduction and weight-bearing was delayed. Jameson et al,<sup>[9]</sup> reported higher rates of dislocation. There was no case of loosening in the present study, all patients were happy with the replacement procedure and they were carrying out all the routine activity of pre-fall level. A reoperation rate as high as 20% is reported in some studies.<sup>[10]</sup> There was no case requiring re-operation in our study.

In our study, no patient was lost to follow up and no mortality was reported. Contrary, many studies are revealing patient death, especially after cemented hemiarthroplasty procedure.<sup>[11-14]</sup>

The final functional outcome between cemented and uncemented bipolar prosthesis on a functional basis did not show any significant difference in the long-term follow up ( $p=0.77$ ). This was

the same outcome as compared with the literature.<sup>[4,5,11-15]</sup>

### **Limitation**

Long term study and large sample size would have been better for comparison between cemented and uncemented hemiarthroplasty. The measure of health-related quality of life using the EQ-5D score and Barthel Index would have given an objective evaluation of functional outcome.

### **CONCLUSION**

Bipolar hemiarthroplasty whether cemented or uncemented is an excellent treatment for fracture neck femur. No significant difference between both methods in terms of functional outcome. Cemented hemiarthroplasty results in more blood loss and takes more operative time but is associated with less post-operative pain and complication and better functional outcome.

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